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EXAMINER	
QUAN, ELIZABETH S	
ART UNIT	**PAPER NUMBER**
1743	7

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

	Application No.	Applicant(s)	
Office Action Summary	09/728,732	BERGH ET AL.	
	Examin r	Art Unit	
	Elizabeth Quan	1743	

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on ____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *116-160,162-166,184 and 185* is/are pending in the application.

4a) Of the above claim(s) ____ is/are withdrawn from consideration.

5)☐ Claim(s) ____ is/are allowed.

6)☒ Claim(s) *116-160,162-166,184 and 185* is/are rejected.

7)☐ Claim(s) ____ is/are objected to.

8)☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on ____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on ____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3,6 .

4) ☐ Interview Summary (PTO-413) Paper No(s). ____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other:

DETAILED ACTION

Drawings

1. This application has been filed with informal drawings, which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.

Specification

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

4. Claims 116-160, 162-166, 184, and 185 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Referring to claims 116, 123, 130, 131, 139, 140, is there at least four materials in each of the at least four microreactors, giving a total of sixteen materials for all of the at least four microreactors, or is there one material per microreactor of the at least four microreactors, giving a total of four materials for all of the at least four microreactors?

6. Referring to claims 117, 126, 135, is there at least ten materials in each of the at least ten microreactors, giving a total of one hundred materials for all of the at least ten microreactors, or is there one material per microreactor of the at least ten microreactors, giving a total of ten materials for all of the at least ten microreactors?

7. Referring to claims 118, 127, is there at least one hundred materials in each of the at least one hundred microreactors, giving a total of 10000 materials for all of the at least one hundred microreactors, or is there one material per microreactor of the at least one hundred microreactors, giving a total of one hundred materials for all of the at least one hundred microreactors?

8. Referring to claim 119, does "material-containing" describe the presence of materials in the laminate? Does the addition of materials make the laminae or laminate the material-containing laminae or laminate? Would the material-containing laminate be the thin film of material containing particles of the material? Is the material-containing laminate the totality of the plurality of laminae with the addition of materials?

9. Referring to claim 120, it is improper to recite "a second laminate or laminates." The claim later recites "engaging the second surface of the materials-containing first laminate and the first surface of the second laminate," such that the first surface of each of the laminate of a plurality of second laminates could not possibly engage the second surface of the materials-containing first laminate. Does the Applicant mean that a plurality of laminates makes up the second laminate and the first surface is one of the exposed surfaces of the plurality of laminates taken together? The "materials-containing first laminate" lacks antecedent basis since only the "first laminate" has been introduced. Is the "materials-containing first laminate" the same as the "first laminate." Referring to the limitation "each of the wells having an interior surface defining an open-ended cavity at the **first surface**," it is recommended that the **first surface** be indicated as the **first surface** of the first laminate or the **first surface** of the second laminate. It is unclear how the wells are arranged to correspond to the arrangement of the materials of the first laminate. Are the wells positioned via moving the first laminate or the second laminate with

wells such that the wells receive the materials? Are the wells made with a spacing that would match the predetermined spacing of materials on a substrate in order to receive the materials?

10. Claims 119-122 recite the limitation "material-containing laminate" or “materials-containing laminate.” There is insufficient antecedent basis for this limitation in the claim.

11. Claim 123 recites the limitation "material-containing microreactors" in lines 14 and 15 of the claim. There is insufficient antecedent basis for this limitation in the claim.

12. Referring to claim 128, it is unclear whether the limitation **an array of candidate materials, the array comprising substantially planar substrate** is describing a film material, which is substantially a planar substrate, or the lamina or laminate, which is substantially a planar substrate, holding an array of materials.

13. Referring to claim 140, the step of simultaneously separating one or more components of the reactor effluents in the four or more microreactors can be construed as either simultaneously separating all of the components within a sample within a microreactor or simultaneously separating all of the samples from all of the reactors.

14. Referring to claim 145, are there four materials in each of the microreactors or does the total of the 250 microreactors have four materials?

15. Referring to claims 152-154, it is unclear how one would vary the residence times. One cannot directly control the residence time of the reactant. Residence times are dictated by the flow rate of the reactants into and out of the reactor. Additionally, does the reactant flow rate account for the flow into or out of the reactor or the entire flow process of into and out of the reactor?. Should there be both a flow rate and residence time in the reaction conditions since they are related?

16. Referring to claim 162, it is unclear how can one control a first set of reaction conditions to be substantially identical in each of the microreactors as well as control a second set of reaction conditions to be varied between two or more of the microreactors in a single method. It is not really possible to complete both steps in a single run. There appears to missing method steps between the steps.

17. Referring to claims 151-154, 162, 165, and 166, do these sets of reaction conditions refer to a single reaction condition, such as temperature, pressure, residence time, or flow rate for the set of microreactors? Or, do these sets of reaction conditions refer to all of the reaction conditions, including temperature, pressure, residence time, and flow rate for a microreactor?

Claim Rejections - 35 USC § 103

18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

19. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

20. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

21. Claims 116-119, 123, 126-128, 130, 139, 142-145, 150-156, 159, 160, 184, 185 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al.

> Referring to claims 116-118, 123, 126-128, 130, 139, 142-145, 150-156, 159, 160, 184, 185, Senkan (Embodiment 1) discloses a method for providing materials to a parallel processing microsystem for identifying and characterizing materials that enhance a chemical reaction (see ABSTRACT; FIGS. 28A and 28B; COL. 5, lines 42-42; COL. 27, lines 58-67; COL. 28, lines 1-10).
>
> It appears Step 2 of FIG. 28A shows simultaneously loading of an array of at least sixteen materials, specifically catalysts, into sixteen or more microreactors, such that the materials are individually resident in a reaction cavity of a separate microreactor (see COL. 27, lines 64 and 65). The microreactors are formed from a lamina, which is substantially planar, with reaction wells, such that the loaded materials are positioned at separate portions of the substrate. Each of the sixteen or more microreactors comprises a surface defining a reaction cavity for carrying out a chemical reaction, an inlet port in fluid communication with the reaction cavity for supplying one or more reactants to the

reaction cavity, and an outlet port in fluid communication with the reaction cavity for discharging a reactor effluent from the reaction cavity (see FIGS. 28A and 28B; COL. 5, lines 42-42; COL. 27, lines 58-67; COL. 28, lines 1-10). It appears the sixteen or more materials are loaded into the sixteen or more microreactors prior to engaging the lamina having the fluid distribution system for passing reactant gases or the lamina having screening monoliths, laser beam, and microelectrodes for discharging reactor effluent with the lamina having the microreactors, and therefore, the loading of at least four materials into the four or more microreactors does not affect the structural integrity of the fluid distribution system through which one or more reactants are supplied to the microreactors or through which one or more reactor effluents are discharged from the microreactors (see FIGS. 28A and 28B).

At least one hundred materials or 250 materials are simultaneously loaded into at least one hundred microreactors or 250 microreactors, respectively, as Senkan discloses that cell densities vary from about 10 to about 500 cells per square inch can be produced with catalyst library sites in which 10 sites per square inch permits creation of over 900 sites on a substrate with dimensions of 8.5 inches by 11 inches, the size of a sheet of letter paper (see COL. 7, lines 8-11; COL. 7, line 67; COL. 8, lines 1-3). Higher library densities are practical for expediting the generation and screening of libraries (see COL. 8, lines 4-13). It appears that this disclosure of Senkan regarding materials is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

It appears Steps 5 and 6 show simultaneously contacting each of the at least sixteen materials with one or more reactors in the sixteen or more microreactors under reaction conditions for the reaction of interest (see FIGS. 28A and 28B; COL. 27, lines 58-67; COL. 28, lines 1-10). Senkan discloses that reactant gases may be simultaneously passed through all library sites to produce reaction product (see COL. 8, lines 51-54; COL. 10, lines 57-59; COL. 17, lines 15-20 and 25-30; COL. 19, lines 2-4) It appears that this disclosure of Senkan regarding simultaneously passing reactant gases through all library sites is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

It appears Steps 5 and 6 show simultaneously discharging a reactor effluent from each of the sixteen or more material-containing microreactors to evaluate catalytic activity (see FIGS. 28A and 28B; COL. 27, lines 58-67; COL. 28, lines 1-10). Senkan also discloses that simultaneous product screening of the catalyst library can be achieved by photoionizing the products using laser beam(s) (23), followed by detection of photoelectrons or photoions using microelectrodes (27) placed inside vacuum chamber (42) in close proximity to the expanding jet (see FIG. 7; COL. 4, lines 7-9, 60, 61, and 65-67; COL. 12, lines 5-8; COL. 17, lines 25-39; COL. 18, lines 1-19; COL. 19, lines 2-22, 34-56; COL. 20, lines 49-51; COL. 21, lines 6-15). Senkan also discloses simultaneously screening catalyst libraries for desirable properties or catalytic activity via parallel analytical measurement of the reactor effluent (see COL. 1, lines 15-22 and 46-50; COL. 2, lines 65-67; COL. 3, lines 1-14 and 17-30; COL. 4, lines 7-9, 13-30, 60, 61, and 65-67; COL. 5, lines 21 and 22; COL. 7, lines 44-48; COL. 8, lines 4-13; COL. 10,

lines 2 and 3; COL. 12, lines 1-12 and 22-67; COLS. 13-15; COL. 16, lines 1-17; COL. 18, lines 1-18; COL. 27, lines 39-41; CLAIM 11). Catalytic activity is determined by separating one or more components of the reactor effluents and determining the presence, absence, or amount of the separated one or more components (see COL. 12, lines 22-67; COLS 13-15). Specifically, reaction product molecules may be fragmented into smaller daughter products, which can be uniquely attributed to a catalytic reaction product molecule that is desired to be detected, by a suitable energy source, such as a pulsed laser beam or plasma arc (see COL. 12, lines 45-49). The daughter product can be selectively photoionized using the REMPI process and detected by a microelectrode (see COL. 12, lines 49-55). The reaction products can be quantified by detection of their fragmentation products (see COL. 12, lines 55-57). It appears that this disclosure of Senkan regarding simultaneously product screening and evaluating the catalyst library for catalytic activity for the chemical reaction of interest is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

Senkan (Embodiment 1) discloses that it is possible to screen an entire catalyst library using a batch mode operation (see COL. 20, lines 15-51). In a batch operation, the catalyst library is first isolated from the reactant gases by a physical mask (see COL. 20, lines 16-18). After reactant gases reach thermal equilibrium, the mask is removed to expose a section or the entire catalyst library to reactant gases (see COL. 20, lines 21-24). Gas is transported into the library by diffusion and natural convection since there is no forced convection, and there is diffusional-mixing between the reactant gases and materials (see COL. 20, lines 15-51). The residence time being greater than the diffusion

time is inherent to a batch reactor in which the reactants virtually remain in the reaction cavity rather than flowing out of the reaction cavity. Therefore, selecting the geometry of the reaction cavity and controlling the reaction conditions in the four or more microreactors such that the reactant residence time is longer than the diffusion period is inherent to the microreactors. It appears that this disclosure of Senkan regarding simultaneously passing reactants through all library sites is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

The materials may be in the form of a film on a portion of surface defining the reaction cavity of the microreactors, and the film may be a Pt or Pd catalyst or a catalyst of organometallic or inorganometallic material or other complex molecules such as enzymes (see COL. 6, lines 46-49 and 62-67; COL. 7, lines 24-26; COL. 23, lines 10-15). In one example the microreactors have 0.5% Pt, 1.0% Pd, 1.0% pt, or 0.5% Pd (see COL. 23, lines 10-32). The material film is formed by solution-based techniques, sol-gel techniques or forming a film of catalyst support material on a portion of the surface defining the reaction cavity and impregnating the catalyst support material with a catalyst or catalyst precursor (see COL. 6, lines 39-67; COL. 7, lines 1-57; COL. 21, lines 16-40; COL. 25, lines 37-52; COL. 27, lines 58-67; COL. 28, lines 1-10). The film may be simultaneously loaded into the microreactors as an array of candidate materials in which each material is substantially planar and positioned at separate portions of the substrate (see FIG. 22). It appears that this disclosure of Senkan regarding materials is general and

applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

Referring to claim 119, it is noted that according to Merriam Webster Collegiate Dictionary that lamina is defined as a thin plate or scale : LAYER, and laminae is the plural form of lamina. Furthermore, the boundaries of the microreactor has not been set forth. It appears from Steps 5 and 6 that the upper lamina or manifold defines the top wall of each of the microreactors. Therefore, at least four or more microreactors are formed in a plurality of laminae and the at least four materials are loaded into the at least four microreactors as a material-containing laminate comprising a substrate and at least four materials at separate portions of the substrate.

Referring to claims 151 and 152, Applicant's specification disclose that important reaction conditions in connection with chemical processes or reactions include primarily temperature, pressure, and reactant residence time. Senkan (Embodiment 1) disclose that the catalyst libraries should be maintain the same pressure, such as atmospheric pressure, during calibration and screening processes to quantify the results of catalyst evaluations (see COL. 9, lines 45-52 and 67; COL. 10, lines 1-3). The temperature may be the same at all catalyst sites, which would be appropriate for screening for new catalysts or to modify catalysts (see COL. 19, lines 64-67). The temperature may be 300 degrees Celsius or higher (see COL. 23, lines 3-5, 24, and 25; COL. 24, lines 47-51). The reactants may be required to reach thermal equilibrium before contact with materials (see COL. 20, lines 19-23). The fluid distribution system is sufficiently large to insure establishment of similar fluid flow rates through each microreactor provided that the

pressure drop characteristics of the microreactors are similar in the effort to achieve the same reactant residence times in each microreactor (see COL. 26, lines 24-28). It appears that this disclosure of Senkan regarding materials is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

Referring to claims 153 and 154, Applicant's specification disclose that important reaction conditions in connection with chemical processes or reactions include primarily temperature, pressure, and reactant residence time. Senkan (Embodiment 1) disclose that the each microreactor may be pressurized at different pressures (see COL. 8, lines 33-35). The temperature of each microreactor may be different (see COL. 11, lines 12-17; COL. 20, lines 1-14). Also, each microreactor may also have its own flow control regulator to provide different residence times in each site (see COL. 11, lines 18-20).

Senkan (Embodiment 1) does not explicitly disclose reaction cavities each with a volume not more than 3 milliliters, 100 microliters, 10 microliters, or 1 microliters. However, Bard discloses that the microreactor has a reaction chamber volume from about 1 nanoliter to 10 microliters to efficiently perform assays requiring a total volume of reagents and samples between 1 nanoliter to 10 microliters (see CLAIM 1). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) to use a reaction cavity having a volume of not more than 3 milliliters, 100 microliters, 10 microliters, or 1 microliters as in Bard to efficiently perform assays requiring a total volume of reagents and samples of less than 3 milliliters or 10 microliters.

Senkan (Embodiment 1) does not explicitly disclose simultaneously discharging reactor effluents from each of the four or more material-containing microreactors. However, Freitag et al. disclose that the product is simultaneously removed from the reactor as reagents are fed into the reactor to efficiently perform assays or synthesize a product (see COL. 2, lines 16-19; COL. 20, lines 1-4). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) to simultaneously discharge reactor effluents from each of the microreactors as in Freitag et al. to efficiently perform assays or synthesize a product.

22. Claims 119-122 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard as applied to claims 116-118 above, and further in view of U.S. Patent No. 6,426,226 to Senkan (Embodiment 2).

Referring to claim 119, Senkan (Embodiment 1) does not show or explicitly disclose the at least four or more microreactors formed in a plurality of laminae. However, Senkan (Embodiment 2) shows at least four microreactors formed in a plurality of laminae to obtain a three-dimensional structure of a plurality of flat microreactor arrays for rapid analysis of a large number of samples (see FIGS. 25 and 32; COL. 5, lines 34, 35, and 59-63; COL. 26, line 67; COL. 27, lines 1-5, 35, and 36). While not necessarily in Senkan (Embodiment 1), Senkan does disclose at least four microreactors formed in a plurality of laminae. It is unclear if Senkan (Embodiment 2) is simply an elaboration of Senkan (Embodiment 1), such that Senkan (Embodiment 1) and Senkan

(Embodiment 2) actually constitute a single embodiment. One would have recognized that the feature of at least four microreactors formed in a plurality of laminae could be applied in Senkan (Embodiment 1).

Referring to claims 120-122, Senkan also discloses a first laminate with first and second surfaces in spaced, substantially parallel relationship to each other (see FIGS. 21-27 and 32). A second laminate with first and second surfaces in spaced, substantially parallel relationship with each other has an array of four or more substantially coplanar wells, which has an interior surface defining an open-ended cavity at the first surface (see FIGS. 21-27 and 32). A second laminate may be a plurality of laminae taken together with the exposed, opposing surfaces as the first and second surfaces in spaced, substantially parallel relationship to each other (see FIGS. 21-27 and 32). Each of the laminae of the second laminate has an array of four or more substantially coplanar wells, which has an interior surface defining an open-ended cavity at the first surface (see FIGS. 21-27 and 32). The second surface of the first laminate and the first surface of the second laminate are releasably engaged or bonded such that the releasably engaged or bonded laminae form an array of four or more microreactors defined by the interior surfaces of the wells and at least a portion of the material-containing regions of the first laminate (see FIGS. 21-27 and 32; COL. 26, lines 48-53). It is noted that both the first and second laminates both comprise of the at least four materials wherein the wells are arranged to correspond with the at least four materials in order to contain the materials in the reaction cavities defined by the laminates. It appears that this disclosure of Senkan is part of Senkan (Embodiment 2), such that it constitutes a single embodiment.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard to provide the at least four or more microreactors in a plurality of laminae as in Senkan (Embodiment 2) to obtain a three-dimensional structure of a plurality of flat microreactor arrays for rapid analysis of a large number of samples.

23. Claims 120-122 and 129 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al. as applied to claims 116-118 above, and further in view of U.S. Patent No. 6,426,226 to Senkan (Embodiment 2) and/or U.S. Patent No. 5,935,277 to Autenrieth et al.

Referring to claims 120-122, Senkan discloses a first laminate with first and second surfaces in spaced, substantially parallel relationship to each other (see FIGS. 21-27 and 32). A second laminate with first and second surfaces in spaced, substantially parallel relationship with each other has an array of four or more substantially coplanar wells, which has an interior surface defining an open-ended cavity at the first surface (see FIGS. 21-27 and 32). A second laminate may be a plurality of laminae taken together with the exposed, opposing surfaces as the first and second surfaces in spaced, substantially parallel relationship to each other (see FIGS. 21-27 and 32). Each of the laminae of the second laminate has an array of four or more substantially coplanar wells, which has an interior surface defining an open-ended cavity at the first surface (see FIGS. 21-27 and 32). The second surface of the first laminate and the first surface of the second laminate are releasably engaged or bonded such that the releasably engaged or bonded

laminae form an array of four or more microreactors defined by the interior surfaces of the wells and at least a portion of the material-containing regions of the first laminate (see FIGS. 21-27 and 32; COL. 26, lines 48-53). It is noted that both the first and second laminates both comprise of the at least four materials wherein the wells are arranged to correspond with the at least four materials in order to contain the materials in the reaction cavities defined by the laminates. It appears that this disclosure of Senkan is part of Senkan (Embodiment 2), such that it constitutes a single embodiment.

Referring to claim 120, it is unclear if the claim was intended to recite that the first laminate has materials even before engaging with the second laminate, such that the first laminate supplies the materials to the second laminate by engaging. In the latter case, Senkan does not explicitly disclose that the first laminate possess materials before engaging with the second laminate. However, Autenrieth et al. disclose that the first laminate has materials for supplying the second laminate with materials in the effort to permit a comparatively simple and trouble free refilling of catalyst material into the reaction chambers (see FIGS. 1-3; COL. 2, lines 1-4; COL. 4, lines 37-67; COLS. 5 and 6; COL. 7, lines 1-3). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard and Senkan (Embodiment 2) to provide a first laminate with materials for supplying the second laminate as in Autenrieth et al. to permit a comparatively simple and trouble free refilling of catalyst material into the reaction chambers.

Referring to claim 129, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. and Senkan (Embodiment 2) do not explicitly disclose simultaneously unloading reactant-contacted materials from the microreactors in which they reside after the chemical reaction of interest. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard and Senkan (Embodiment 2) to simultaneously unload reactant-contacted materials from the microreactors in which they reside after the chemical reaction of interest to efficiently and time effectively unload the microreactors for the next run. Additionally, Autenrieth et al. disclose simultaneously unloading reactant-contacted materials from the microreactors (1a) in which they reside after the chemical reaction of interest without difficulty and without requiring demounting operations on the reactor housing (see COL. 7, lines 4-35). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard and/or Freitag et al. and Senkan (Embodiment 2) to simultaneously unload reactant-contacted materials from the microreactors in which they reside after the chemical reaction of interest as in Autenrieth et al. efficiently and time effectively.

24. Claims 124 and 125 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al. as applied to claim 123 above, and further in view of U.S. Patent No. 4,921,919 to Lin et al. and/or U.S. Patent No. 5,079,205 to Cinch.

Referring to claims 124 and 125, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. do not quantify the amount of material, specifically in milligrams. Given the small microreactor volumes of not more than 10 microliters as disclosed by Bard, it appears that the material should not exceed 5 mg or even 1 mg without overfilling the reaction cavity unless the material is extremely dense. Furthermore, it has been held that discovering optimum or workable ranges (*In re Aller*, 105 USPQ 233) or optimum value of a result effective variable (*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPQ 1980) involves only routine skill in the art. Additionally, Lin et al. disclose that the amount of catalyst used varies depending on choice of polymerization technique, reactor size, monomer to be polymerized, and other factors known to persons of skill in the art (see COL. 5, lines 3-8). Canich discloses using 0.404 mg of catalyst in a reactor in a polymerization process to produce polyethylene (see COL. 17, lines1-11). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard and/or Freitag et al. to provide not more than 1 mg of catalyst as in Lin et al. and/or Canich as necessary or desired depending on polymerization technique, reactor size, monomer to be polymerized, and other factors known to persons of skill in the art.

25. Claims 131-138, 141, are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and U.S. Patent No. 5,959,297 to Weinberg et al. and/or U.S. Patent No. 6,087,181 to Cong and/or U.S. Patent No. 6,485,692 to Freitag et al.

Referring to claims 131-138, 141, Senkan (Embodiment 1) discloses a method for providing materials to a parallel processing microsystem for identifying and characterizing materials that enhance a chemical reaction (see ABSTRACT; FIGS. 28A and 28B; COL. 5, lines 42-42; COL. 27, lines 58-67; COL. 28, lines 1-10).

It appears Step 2 of FIG. 28A shows simultaneously loading of an array of at least sixteen materials, specifically catalysts, into sixteen or more microreactors, such that the materials are individually resident in a reaction cavity of a separate microreactor (see COL. 27, lines 64 and 65). The microreactors are formed from a lamina, which is substantially planar, with reaction wells, such that the loaded materials are positioned at separate portions of the substrate. Each of the sixteen or more microreactors comprises a surface defining a reaction cavity for carrying out a chemical reaction, an inlet port in fluid communication with the reaction cavity for supplying one or more reactants to the reaction cavity, and an outlet port in fluid communication with the reaction cavity for discharging a reactor effluent from the reaction cavity (see FIGS. 28A and 28B; COL. 5, lines 42-42; COL. 27, lines 58-67; COL. 28, lines 1-10). It appears the sixteen or more materials are loaded into the sixteen or more microreactors prior to engaging the lamina having the fluid distribution system for passing reactant gases or the lamina having screening monoliths, laser beam, and microelectrodes for discharging reactor effluent with the lamina having the microreactors, and therefore, the loading of at least four materials into the four or more microreactors does not affect the structural integrity of the fluid distribution system through which one or more reactants are supplied to the

microreactors or through which one or more reactor effluents are discharged from the microreactors (see FIGS. 28A and 28B).

At least one hundred materials are simultaneously loaded into at least one hundred microreactors, as Senkan discloses that cell densities vary from about 10 to about 500 cells per square inch can be produced with catalyst library sites in which 10 sites per square inch permits creation of over 900 sites on a substrate with dimensions of 8.5 inches by 11 inches, the size of a sheet of letter paper (see COL. 7, lines 8-11; COL. 7, line 67; COL. 8, lines 1-3). Higher library densities are practical for expediting the generation and screening of libraries (see COL. 8, lines 4-13). It appears that this disclosure of Senkan regarding materials is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

It appears Steps 5 and 6 show simultaneously contacting each of the at least sixteen materials with one or more reactors in the sixteen or more microreactors under reaction conditions for the reaction of interest (see FIGS. 28A and 28B; COL. 27, lines 58-67; COL. 28, lines 1-10). Senkan discloses that reactants may be simultaneously passed through all library sites (see COL. 8, lines 51-54; COL. 10, lines 57-59; COL. 17, lines 15-20 and 25-30; COL. 19, lines 2-4) It appears that this disclosure of Senkan regarding simultaneously passing reactants through all library sites is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

It appears Steps 5 and 6 show simultaneously discharging a reactor effluent from each of the sixteen or more material-containing microreactors to evaluate catalytic activity (see FIGS. 28A and 28B; COL. 27, lines 58-67; COL. 28, lines 1-10). Senkan also discloses that simultaneous product screening of the catalyst library can be achieved by photoionizing the products using laser beam(s) (23), followed by detection of photoelectrons or photoions using microelectrodes (27) placed inside vacuum chamber (42) in close proximity to the expanding jet (see FIG. 7; COL. 4, lines 7-9, 60, 61, and 65-67; COL. 12, lines 5-8; COL. 17, lines 25-39; COL. 18, lines 1-19; COL. 19, lines 2-22, 34-56; COL. 20, lines 49-51; COL. 21, lines 6-15). Senkan also discloses simultaneously screening catalyst libraries for desirable properties (see COL. 1, lines 15-22 and 46-50; COL. 2, lines 65-67; COL. 3, lines 1-14 and 17-30; COL. 4, lines 13-30; COL. 7, lines 44-48; COL. 8, lines 4-13; COL. 10, lines 2 and 3; COL. 12, lines 22-26; COL. 27, lines 39-41; CLAIM 11). It appears that this disclosure of Senkan regarding simultaneously product screening and evaluating the catalyst library for catalytic activity for the chemical reaction of interest is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

The materials may be in the form of a film on a portion of surface defining the reaction cavity of the microreactors, and the film may be a Pt or Pd catalyst or a catalyst of organometallic or inorganometallic material or other complex molecules such as enzymes (see COL. 6, lines 46-49 and 62-67; COL. 7, lines 24-26; COL. 23, lines 10-15). In one example the microreactors have 0.5% Pt, 1.0% Pd, 1.0% pt, or 0.5% Pd (see COL. 23, lines 10-32). The material film is formed by solution-based techniques, sol-gel

techniques or forming a film of catalyst support material on a portion of the surface defining the reaction cavity and impregnating the catalyst support material with a catalyst or catalyst precursor (see COL. 6, lines 39-67; COL. 7, lines 1-57; COL. 21, lines 16-40; COL. 25, lines 37-52; COL. 27, lines 58-67; COL. 28, lines 1-10). The film may be simultaneously loaded into the microreactors as an array of candidate materials in which each material is substantially planar and positioned at separate portions of the substrate (see FIG. 22). It appears that this disclosure of Senkan regarding materials is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1). It is noted that materials can be interpreted as particles, and FIGS. 21-32 appear to show an infinite amount of particles. The shape and size of materials make individual materials different from each other. Therefore, at least ten different materials in the ten or more microreactors are inherent to the catalyst particles in the system.

Senkan (Embodiment 1) discloses that the time required to transfer reaction products from the microreactors to the mass spectrometer can be in the order of microseconds to tens of milliseconds and mass spectrometric data can be obtained in the order of several hundred milliseconds, especially when specific mass ions are monitored (see COL. 10, lines 46-53). These times indicate a high throughput of well over 1000 materials per hour.

Senkan (Embodiment 1) does not explicitly disclose simultaneously discharging reactor effluents from each of the four or more material-containing microreactors. However, Freitag et al. disclose that the product is simultaneously removed from the

reactor as reagents are fed into the reactor to efficiently perform assays or synthesize a product (see COL. 2, lines 16-19; COL. 20, lines 1-4). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) to simultaneously discharge reactor effluents from each of the microreactors as in Freitag et al. to efficiently perform assays or synthesize a product.

Senkan (Embodiment 1) does not explicitly disclose reaction cavities each with a volume not more than 3 milliliters or 10 microliters. However, Bard discloses that the microreactor has a reaction chamber volume from about 1 nanoliter to 10 microliters to efficiently perform assays requiring a total volume of reagents and samples between 1 nanoliter to 10 microliters (see CLAIM 1). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) to use a reaction cavity having a volume of not more than 3 milliliters or 10 microliters as in Bard to efficiently perform assays requiring a total volume of reagents and samples of less than 3 milliliters or 10 microliters.

Senkan (Embodiment 1) does not explicitly disclose the difference between the time (t1) for loading the at least four materials into the at least four microreactors and the time (t2) for evaluating the at least four materials for catalytic activity for the chemical reaction of interest or (t1-t2) being less than about 3 hours, not more than about 1 hour, not more than about 30 minutes, or not more than about 15 minutes. However, Weinberg et al. disclose a method of screening materials arrayed on a substrate that includes providing a plurality of materials arrayed on the substrate, reacting each of the materials

arrayed on the substrate with one or more gas-phase reactants to form one or more products, obtaining gas samples from locations adjacent to the materials following the reacting step, and measuring an amount of at least one of the products in each of the gas samples by mass spectrometry (see CLAIM 1). The total time for completing contacting, obtaining, and measuring is one average less than about one hundred seconds, less than about ten seconds, less than about one second, less than about 0.1 second, or less than about 0.01 second for each of the materials (see CLAIMS 23-27). Taking the maximum of the total time for completing contacting, obtaining, and measuring or one hundred seconds, four hundred seconds or about 6.7 minutes would be required for the complete process of loading the four materials into the microreactors to evaluating the four materials for catalytic activity for the chemical reaction of interest. At this rate 36 materials would be screened per hour. More materials would actually be evaluated in an hour since the screening time also includes loading, reacting, and discharging time. Taking the minimum of the total time for completing contacting, obtaining, and measuring or 0.01 seconds, 0.04 seconds or about 0.0007 minutes would be required for the complete process of loading the four materials into the microreactors to evaluating the four materials for catalytic activity for the chemical reaction of interest. At this rate 360000 materials would be screened per hour. More materials would actually be evaluated in an hour since the screening time also includes loading, reacting, and discharging time. Weinberg et al. also disclose that the system preferably scans and measures an array at rates of approximately 1 library element every 10 seconds, 1 library element every 100 seconds, or 10, 100, or 1000 library elements per second (see COL. 4,

line 67; COL. 5, lines 1-6). Weinberg et al. do not disclose the time for simultaneously completing the steps of screening. However, the purpose of Weinberg et al. is to provide the limitation of times for combination with Senkan (Embodiment 1), which does disclose a simultaneous screening method, in view of Bard. Taking 100 seconds for the screening process, it would also be reasonable that simultaneous screening of the four materials would be 100 seconds for all of the four materials since performing simultaneous screening would only involve more dispensers or nozzles to distribute gas in a single lamina, more outlet ports to discharge effluent in a single lamina, and more probes and channels to evaluate the materials in a single lamina, which are all very well known. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard to have the difference between the time (t1) for loading the at least four materials into the at least four microreactors and the time (t2) for evaluating the at least four materials for catalytic activity for the chemical reaction of interest or (t1-t2) being less than about 3 hours, not more than about 1 hour, not more than about 30 minutes, or not more than about 15 minutes as in Weinberg et al. to more efficiently and time effectively screen materials in order to screen more materials per unit of time.

Referring to claim 138, Senkan (Embodiment 1) in view of Bard do not explicitly disclose that the at least ten materials are at least ten different materials. It is noted that materials can be interpreted as particles, and FIGS. 21-32 appear to show an infinite amount of particles. The shape and size of materials make individual materials different from each other. Therefore, at least ten different materials in the ten or more

microreactors are inherent to the catalyst particles in the system. Even if the materials were interpreted as materials of different composition, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide as many different materials as necessary to perform a reaction. Weinberg et al. disclose a library of 2 mm x 2 mm compounds with a c/c spacing of 4 mm gives a library of 20 x 20 or 400 different compounds and a library of 0.1 mm x 0.1 mm elements with a c/c spacing of 0.2 mm gives a library of 400 x 400 or 160,000 different compounds (see COL. 21, lines 18-22). A diverse array of materials are screened for useful properties and compared for relative performance prior to preparing materials on a large or bulk scale (see COL. 12, lines 3-37). Cong also discloses that the catalyst library consists of 66 different catalysts to measure ethylene production from the dehydrogenation of ethane in the presence of different catalysts (see COL. 8, lines 62-67; COL. 9, lines 1-5). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard to use at least ten different materials as in Weinberg et al. and/or Cong to screen a diverse array of materials for useful properties and compared for relative performance prior to preparing materials on a large or bulk scale.

26. Claims 140, 162, 164-166 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and U.S. Patent No. 6,103,199 to Bjornson et al. and U.S. Patent No. 5,959,297 to Weinberg et al. and/or U.S. Patent No. 3,797,202 to Neulander et al. and/or U.S. Patent No. 6,485,692 to Freitag et al.

Referring to claims 140, 162, 164-166, Senkan (Embodiment 1) discloses a method for providing materials to a parallel processing microsystem for identifying and characterizing materials that enhance a chemical reaction (see ABSTRACT; FIGS. 28A and 28B; COL. 5, lines 42-42; COL. 27, lines 58-67; COL. 28, lines 1-10).

It appears Step 2 of FIG. 28A shows simultaneously loading of an array of at least sixteen materials, specifically catalysts, into sixteen or more microreactors, such that the materials are individually resident in a reaction cavity of a separate microreactor (see COL. 27, lines 64 and 65). The microreactors are formed from a lamina, which is substantially planar, with reaction wells, such that the loaded materials are positioned at separate portions of the substrate. Each of the sixteen or more microreactors comprises a surface defining a reaction cavity for carrying out a chemical reaction, an inlet port in fluid communication with the reaction cavity for supplying one or more reactants to the reaction cavity, and an outlet port in fluid communication with the reaction cavity for discharging a reactor effluent from the reaction cavity (see FIGS. 28A and 28B; COL. 5, lines 42-42; COL. 27, lines 58-67; COL. 28, lines 1-10). It appears the sixteen or more materials are loaded into the sixteen or more microreactors prior to engaging the lamina having the fluid distribution system for passing reactant gases or the lamina having screening monoliths, laser beam, and microelectrodes for discharging reactor effluent with the lamina having the microreactors, and therefore, the loading of at least four materials into the four or more microreactors does not affect the structural integrity of the fluid distribution system through which one or more reactants are supplied to the

microreactors or through which one or more reactor effluents are discharged from the microreactors (see FIGS. 28A and 28B).

At least one hundred materials are simultaneously loaded into at least one hundred microreactors, as Senkan discloses that cell densities vary from about 10 to about 500 cells per square inch can be produced with catalyst library sites in which 10 sites per square inch permits creation of over 900 sites on a substrate with dimensions of 8.5 inches by 11 inches, the size of a sheet of letter paper (see COL. 7, lines 8-11; COL. 7, line 67; COL. 8, lines 1-3). Higher library densities are practical for expediting the generation and screening of libraries (see COL. 8, lines 4-13). It appears that this disclosure of Senkan regarding materials is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

It appears Steps 5 and 6 show simultaneously contacting each of the at least sixteen materials with one or more reactors in the sixteen or more microreactors under reaction conditions for the reaction of interest (see FIGS. 28A and 28B; COL. 27, lines 58-67; COL. 28, lines 1-10). Senkan discloses that reactants may be simultaneously passed through all library sites (see COL. 8, lines 51-54; COL. 10, lines 57-59; COL. 17, lines 15-20 and 25-30; COL. 19, lines 2-4) It appears that this disclosure of Senkan regarding simultaneously passing reactants through all library sites is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

It appears Steps 5 and 6 show simultaneously discharging a reactor effluent from each of the sixteen or more material-containing microreactors to evaluate catalytic activity (see FIGS. 28A and 28B; COL. 27, lines 58-67; COL. 28, lines 1-10). Senkan also discloses that simultaneous product screening of the catalyst library can be achieved by photoionizing the products using laser beam(s) (23), followed by detection of photoelectrons or photoions using microelectrodes (27) placed inside vacuum chamber (42) in close proximity to the expanding jet (see FIG. 7; COL. 4, lines 7-9, 60, 61, and 65-67; COL. 12, lines 5-8; COL. 17, lines 25-39; COL. 18, lines 1-19; COL. 19, lines 2-22, 34-56; COL. 20, lines 49-51; COL. 21, lines 6-15). Senkan also discloses simultaneously screening catalyst libraries for desirable properties (see COL. 1, lines 15-22 and 46-50; COL. 2, lines 65-67; COL. 3, lines 1-14 and 17-30; COL. 4, lines 13-30; COL. 7, lines 44-48; COL. 8, lines 4-13; COL. 10, lines 2 and 3; COL. 12, lines 22-26; COL. 27, lines 39-41; CLAIM 11). It appears that this disclosure of Senkan regarding simultaneously product screening and evaluating the catalyst library for catalytic activity for the chemical reaction of interest is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

The materials may be in the form of a film on a portion of surface defining the reaction cavity of the microreactors, and the film may be a Pt or Pd catalyst or a catalyst of organometallic or inorganometallic material or other complex molecules such as enzymes (see COL. 6, lines 46-49 and 62-67; COL. 7, lines 24-26; COL. 23, lines 10-15). In one example the microreactors have 0.5% Pt, 1.0% Pd, 1.0% pt, or 0.5% Pd (see COL. 23, lines 10-32). The material film is formed by solution-based techniques, sol-gel

techniques or forming a film of catalyst support material on a portion of the surface defining the reaction cavity and impregnating the catalyst support material with a catalyst or catalyst precursor (see COL. 6, lines 39-67; COL. 7, lines 1-57; COL. 21, lines 16-40; COL. 25, lines 37-52; COL. 27, lines 58-67; COL. 28, lines 1-10). The film may be simultaneously loaded into the microreactors as an array of candidate materials in which each material is substantially planar and positioned at separate portions of the substrate (see FIG. 22). It appears that this disclosure of Senkan regarding materials is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1). It is noted that materials can be interpreted as particles, and FIGS. 21-32 appear to show an infinite amount of particles. The shape and size of materials make individual materials different from each other. Therefore, at least ten different materials in the ten or more microreactors are inherent to the catalyst particles in the system.

Applicant's specification discloses that important reaction conditions in connection with chemical processes or reactions include primarily temperature, pressure, and reactant residence time. Senkan (Embodiment 1) disclose that the catalyst libraries should be maintain the same pressure, such as atmospheric pressure, during calibration and screening processes to quantify the results of catalyst evaluations (see COL. 9, lines 45-52 and 67; COL. 10, lines 1-3). The temperature may be the same at all catalyst sites, which would be appropriate for screening for new catalysts or to modify catalysts (see COL. 19, lines 64-67). The temperature may be 300 degrees Celsius or higher (see COL. 23, lines 3-5, 24, and 25; COL. 24, lines 47-51). The reactants may be required to reach

thermal equilibrium before contact with materials (see COL. 20, lines 19-23). The fluid distribution system is sufficiently large to insure establishment of similar fluid flow rates through each microreactor provided that the pressure drop characteristics of the microreactors are similar in the effort to achieve the same reactant residence times in each microreactor (see COL. 26, lines 24-28). It appears that this disclosure of Senkan regarding materials is general and applies to all embodiments, such that it elaborates on Senkan (Embodiment 1) and would be a part of Senkan (Embodiment 1).

Applicant's specification discloses that important reaction conditions in connection with chemical processes or reactions include primarily temperature, pressure, and reactant residence time. Senkan (Embodiment 1) disclose that the each microreactor may be pressurized at different pressures (see COL. 8, lines 33-35). The temperature of each microreactor may be different (see COL. 11, lines 12-17; COL. 20, lines 1-14). Also, each microreactor may also have its own flow control regulator to provide different residence times in each site (see COL. 11, lines 18-20).

Referring to claim 158, Senkan (Embodiment 1) disclose that different catalytic materials can be deposited into different reactor passages of the library (see COL. 25, lines 17-21). Senkan (Embodiment 1) more specifically disclose that a different catalyst may be placed in each microreactor using any of the techniques described (see COL. 26, lines 30-32). It appears that all of the catalysts in each of the microreactors are different.

Senkan (Embodiment 1) discloses that the time required to transfer reaction products from the microreactors to the mass spectrometer can be in the order of microseconds to tens of milliseconds and mass spectrometric data can be obtained in the

order of several hundred milliseconds, especially when specific mass ions are monitored (see COL. 10, lines 46-53). These times indicate a high throughput of well over 1000 materials per hour.

Senkan (Embodiment 1) does not explicitly disclose simultaneously discharging reactor effluents from each of the four or more material-containing microreactors. However, Freitag et al. disclose that the product is simultaneously removed from the reactor as reagents are fed into the reactor to efficiently perform assays or synthesize a product (see COL. 2, lines 16-19; COL. 20, lines 1-4). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) to simultaneously discharge reactor effluents from each of the microreactors as in Freitag et al. to efficiently perform assays or synthesize a product.

Senkan (Embodiment 1) does not explicitly disclose reaction cavities each with a volume not more than 3 milliliters or 10 microliters. However, Bard discloses that the microreactor has a reaction chamber volume from about 1 nanoliter to 10 microliters to efficiently perform assays requiring a total volume of reagents and samples between 1 nanoliter to 10 microliters (see CLAIM 1). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) to use a reaction cavity having a volume of not more than 3 milliliters or 10 microliters as in Bard to efficiently perform assays requiring a total volume of reagents and samples of less than 3 milliliters or 10 microliters.

Senkan (Embodiment 1) in view of Bard doe not disclose simultaneously separating one or more components of the reactor effluents in the four or more microseparators. It is very well known in the art to use multiple separators for multiple reactors to prevent contamination amount reactors and allow simultaneous separation of the components of the reactors to decrease the overall screening time. It is also very well known to separate a sample to reduce particulate matter, which would produce noise in data. Weinberg et al. disclose that it is desirable to separate one or more components of the reactor effluents in the four or more microseparators to selectively block or reject charged particles of an undesirable mass-to-charge ratio in order to quickly characterize compounds in arrays of materials for discovering and/or optimizing new materials with specific desired properties (see ABSTRACT; COL. 5, lines 19-21; COL. 13, lines 56-65; COL. 14, lines 24-32). Bjornson et al. disclose that separation of transferred samples is conducted simultaneously by more than four separators to more quickly filter samples to decrease the time needed for overall screening of materials (see COL. 8, lines 9-11). Neulander et al. also disclose at least four separators, either interpreted as the four cavities in the corner as show in FIG. 1 or the cavities in the layers as shown in FIGS. 2-5. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard to simultaneously separate one or more components of the reactor effluents in the four or more microreactors as in Bjornson et al. and/or Weinberg et al. and/or Neulander et al. to efficiently filter samples to decrease the noise in data by reducing particulate matter in the sample.

27. Claims 146, 147, 149 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al. as to claim 145 above, and further in view of U.S. Patent No. 6,149,882 to Guan et al. and/or U.S. Patent No. 5,935,277 to Autenrieth et al. and/or U.S. Patent No. 3,966,420 to Pegels et al.

Referring to claims 146, 147, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. do not explicitly disclose unloading the at least four reactant-contacted materials from the microreactors in which they reside and loading a second set of at least four materials into the four or more microreactors such that the second set of at least four materials are individually resident in separate reactors. However, it is very well known to unload reactant-contacted materials to load new materials into the reactors to prevent contamination between runs. Pegels et al. disclose that unloading the catalyst is necessary and loading new catalyst is necessary to prevent contamination and using deteriorated catalyst since catalytic activity diminishes rapidly (see COL. 1, lines 29-46). Autenrieth et al. disclose a method and apparatus of simultaneously unloading the at least four reactant-contacted materials from the microreactors (1a) in which they reside and simultaneously loading a second set of at least four materials into the four or more microreactors (1a) of the chemical processing microsystem such that the second set of at least four materials are individually resident in separate microreactors (1a) (see FIGS. 1-3; COL. 1, lines 49-52; COL. 4, lines 3-8 and 59-67; COLS. 5-7). Guan et al. disclose screening library members based on their ability to catalyze the conversion of ethane to ethylene by loading six vessels with the same catalyst and subjecting the catalysts to

different temperatures (see COL. 15, lines 33-35). After measurements were taken, vessels 1-3 were loaded with a second, fresh catalyst, and vessels 4-6 reused the same catalyst (see COL. 15, lines 33-39). It would have been obvious to unload and load one more vessel as necessary or desired to perform the required number of assays. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard and/or Freitag et al. to unload the at least four reactant-contacted materials from the microreactors and load a second set of at least four materials as in Guan et al. and/or Autenrieth et al. and/or Pegels et al. to prevent contamination between runs and replenish with fresh catalysts since catalytic activity diminishes rapidly.

Referring to claim 149, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. and further in view of Guan et al. and/or Autenrieth et al. and/or Pegels et al. do not explicitly disclose automating loading and unloading of materials into and from the microreactors. However, it is very well known to automate loading and unloading of materials into and from the microreactors to reduce error by humans and increase efficiency. It has also been held that providing mechanical or automatic means to replace manual activity, which accomplishes the task and produces the same result is within the skill of a routineer in the art (*In re Venner*, 120 USPQ 192 (CCPA 1960)).

28. Claim148 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al. and in view of U.S. Patent No. 6,149,882 to Guan et al. and/or U.S. Patent No. 5,935,277 to Autenrieth et al. and/or U.S. Patent No. 3,966,420 to Pegels

et al. as applied to claims 146, 147, and 149 above, and further in view of U.S. Patent No. 5,959,297 to Weinberg et al.

Referring to claim 148, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. and further in view of Guan et al. and/or Autenrieth et al. and/or Pegels et al. do not explicitly disclose sequentially loading at least four materials into the four or more microreactors. It is very well known to sequentially rather than simultaneously load materials into and from the microreactors if a precise and accurate amount of the material must be distributed into the microreactors. Furthermore, Weinberg et al. disclose an array of materials is prepared by successively delivering components of the materials to predefined regions on a substrate (see COL. 8, lines 58-60). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan in view of Bard and/or Freitag et al. and further in view of Guan et al. and/or Autenrieth et al. and/or Pegels et al. to sequentially load materials as in Weinberg et al. to carefully transfer precise and accurate amounts of materials into predefined regions on a substrate.

29. Claim 157 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al. as applied to claim 145 above, and further in view of WO 96/15576 to Zanzucchi et al.

Referring to claim 157, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. do not disclose at least 1000 microreactors. However, it is very well known in the art to increase the number of microreactors as necessary to perform more reactions

simultaneously. Furthermore, it has been held that duplication of essential working parts involves only routine skill in the art (*St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8). Zanzucchi et al. disclose a chemical processing microsystem with a microreactor structure comprising from 10 to 1000 microreactors (see FIGS. 1-21; PAGES 1-4; PAGE 11, lines 3-8). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Senkan (Embodiment 1) in view of Bard and/or Freitag et al. to provide at least 1000 microreactors as in Zanzucchi et al. to perform at least 1000 reactions simultaneously as necessary or desired.

30. Claim 158 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al. as applied to claim 145 above, and further in view of U.S. Patent No. 5,959,297 to Weinberg et al. and/or U.S. Patent No. 6,087,181 to Cong.

Referring to clam 158, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. do not explicitly disclose different candidate materials individually resident in separate reaction cavities of at least 90% of the 250 or more reactors. It is noted that materials can be interpreted as particles, and FIGS. 21-32 appear to show an infinite amount of particles. The shape and size of materials make individual materials different from each other. Therefore, at least ten different materials in the ten or more microreactors are inherent to the catalyst particles in the system. Even if the materials were interpreted as materials of different composition, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide as many different materials

as necessary to perform a reaction. It is also very well known to conduct different reactions in each reaction cavity wither 90% or more of the microreactors have different reactions to compare results of the different compositions (i.e. varying the concentrations to determine the effect on conductivity or absorbance, etc.). Weinberg et al. disclose a library of 2 mm x 2 mm compounds with a c/c spacing of 4 mm gives a library of 20 x 20 or 400 different compounds and a library of 0.1 mm x 0.1 mm elements with a c/c spacing of 0.2 mm gives a library of 400 x 400 or 160,000 different compounds (see COL. 21, lines 18-22). A diverse array of materials are screened for useful properties and compared for relative performance prior to preparing materials on a large or bulk scale (see COL. 12, lines 3-37). Cong also discloses that the catalyst library consists of 66 different catalysts to measure ethylene production from the dehydrogenation of ethane in the presence of different catalysts (see COL. 8, lines 62-67; COL. 9, lines 1-5). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard and/or Freitag et al. to use at least ten different materials as in Weinberg et al. and/or Cong to screen a diverse array of materials (i.e. at least 90% of the materials in the microreactors are different) for useful properties and compared for relative performance prior to preparing materials on a large or bulk scale.

31. Claim 163 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,426,226 to Senkan (Embodiment 1) in view of U.S. Patent No. 5,580,523 to Bard and/or U.S. Patent No. 6,485,692 to Freitag et al. and U.S. Patent No. 6,103,199 to Bjornson et al. and U.S. Patent No. 5,959,297 to Weinberg et al. and/or U.S. Patent No. 3,797,202 to Neulander et al., as

applied to claim 162 above, and further in view of U.S. Patent No. 6,426,226 to Senkan (Embodiment 2)

Referring to claim 163, Senkan (Embodiment 1) in view of Bard and/or Freitag et al. and Bjornson et al. and Weinberg et al. and/or Neulander et al. do not show or explicitly disclose the at least four or more microreactors formed in a plurality of laminae. However, Senkan (Embodiment 2) shows at least four microreactors formed in a plurality of laminae to obtain a three-dimensional structure of a plurality of flat microreactor arrays for rapid analysis of a large number of samples (see FIGS. 25 and 32; COL. 5, lines 34, 35, and 59-63; COL. 26, line 67; COL. 27, lines 1-5, 35, and 36). While not necessarily in Senkan (Embodiment 1), Senkan does disclose at least four microreactors formed in a plurality of laminae. It is unclear if Senkan (Embodiment 2) is simply an elaboration of Senkan (Embodiment 1), such that Senkan (Embodiment 1) and Senkan (Embodiment 2) actually constitute a single embodiment. One would have recognized that the feature of at least four microreactors formed in a plurality of laminae could be applied in Senkan (Embodiment 1).

Senkan also discloses a first laminate with first and second surfaces in spaced, substantially parallel relationship to each other (see FIGS. 21-27 and 32). A second laminate with first and second surfaces in spaced, substantially parallel relationship with each other has an array of four or more substantially coplanar wells, which has an interior surface defining an open-ended cavity at the first surface (see FIGS. 21-27 and 32). A second laminate may be a plurality of laminae taken together with the exposed, opposing surfaces as the first and second surfaces in spaced, substantially parallel relationship to

each other (see FIGS. 21-27 and 32). Each of the laminae of the second laminate has an array of four or more substantially coplanar wells, which has an interior surface defining an open-ended cavity at the first surface (see FIGS. 21-27 and 32). The second surface of the first laminate and the first surface of the second laminate are releasably engaged or bonded such that the releasably engaged or bonded laminae form an array of four or more microreactors defined by the interior surfaces of the wells and at least a portion of the material-containing regions of the first laminate (see FIGS. 21-27 and 32; COL. 26, lines 48-53). It is noted that both the first and second laminates both comprise of the at least four materials wherein the wells are arranged to correspond with the at least four materials in order to contain the materials in the reaction cavities defined by the laminates. It appears that this disclosure of Senkan is part of Senkan (Embodiment 2), such that it constitutes a single embodiment.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Senkan (Embodiment 1) in view of Bard and/or Freitag et al. and Bjornson et al. and Weinberg et al. and/or U.S. Patent No. 3,797,202 to Neulander et al. to provide the at least four or more microreactors in a plurality of laminae as in Senkan (Embodiment 2) to obtain a three-dimensional structure of a plurality of flat microreactor arrays for rapid analysis of a large number of samples.

32. Claims 116-118, 123, 126, 127, 129-134, 135-139, 141-154, 156-160, 162-166, 184, and 185 are provisionally rejected under 35 U.S.C. 103(a) as being obvious over copending Application No. 09/607535 which has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the copending application, it would constitute prior

art under 35 U.S.C. 102(e) if published or patented. This provisional rejection under 35 U.S.C. 103(a) is based upon a presumption of future publication or patenting of the conflicting application. The claims are essentially similar with the exception of the applications not claiming the number of microreactors or volume of the microreactors. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the number of microreactors as required to complete a certain number of assays or the volume of a microreactor to efficiently perform assays using small amounts of samples.

This provisional rejection might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the copending application was derived from the inventor of this application and is thus not the invention "by another," or by a showing of a date of invention for the instant application prior to the effective U.S. filing date of the copending application under 37 CFR 1.131. For applications filed on or after November 29, 1999, this rejection might also be overcome by showing that the subject matter of the reference and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person. See MPEP § 706.02(l)(1) and § 706.02(l)(2).

33. Claims 116-118, 123, 126, 127, 129-134, 135-139, 141-154, 156-160, 162-166, 184, and 185 are rejected under 35 U.S.C. 103(a) as being obvious over US 2002/0042140 to Hagemeyer et al.

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37

CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). For applications filed on or after November 29, 1999, this rejection might also be overcome by showing that the subject matter of the reference and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person. See MPEP § 706.02(l)(1) and § 706.02(l)(2). The claims are essentially similar with the exception of the applications not claiming the number of microreactors or volume of the microreactors. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the number of microreactors as required to complete a certain number of assays or the volume of a microreactor to efficiently perform assays using small amounts of samples.

Double Patenting

34. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground

provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

35. Claims 116-118, 123, 126, 127, 129-134, 135-139, 141-154, 156-160, 162-166, 184, and 185 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 61, 62, 65, 66, 70, 71, 72, 82, 83-92, 94, 96, 98-103 of copending Application No. 09/607535 in view of U.S. Patent No. 5,580,523 to Bard and/or WO 96/15576 to Zanzucchi et al. Application No. 09/607535 recites the limitations of the claims in the immediate application except for the volume of the reaction cavity and the number of reactors. Bard discloses that the microreactor has a reaction chamber volume from about 1 nanoliter to 10 microliters to efficiently perform assays requiring a total volume of reagents and samples between 1 nanoliter to 10 microliters (see CLAIM 1). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of 09/607535 to use a reaction cavity having a volume of not more than 3 milliliters, 100 microliters, 10 microliters, or 1 microliters as in Bard to efficiently perform assays requiring a total volume of reagents and samples of less than 3 milliliters or 10 microliters. It is very well known in the art to increase the number of microreactors as necessary to perform more reactions simultaneously. Furthermore, it has been held that duplication of essential working parts involves only routine skill in the art (*St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8). Zanzucchi et al. disclose a chemical processing microsystem with a microreactor structure comprising from 10 to 1000 microreactors (see FIGS. 1-21; PAGES 1-4; PAGE 11, lines 3-8). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was

made to modify the system of 09/607535 to provide at least 1000 microreactors as in Zanzucchi et al. to perform at least 1000 reactions simultaneously as necessary or desired.

This is a provisional obviousness-type double patenting rejection.

Claims 116-118, 123, 126, 127, 129-134, 135-139, 141-154, 156-160, 162-166, 184, and 185 are directed to an invention not patentably distinct from claims 61, 62, 65, 66, 70, 71, 72, 82, 83-92, 94, 96, 98-103 of commonly assigned Application No. 09/607535. Specifically, the claims are essentially similar with the exception of the applications not claiming the number of microreactors or volume of the microreactors. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the number of microreactors as required to complete a certain number of assays or the volume of a microreactor to efficiently perform assays using small amounts of samples.

The U.S. Patent and Trademark Office normally will not institute an interference between applications or a patent and an application of common ownership (see MPEP § 2302). Commonly assigned applications and publications, discussed above, would form the basis for a rejection of the noted claims under 35 U.S.C. 103(a) if the commonly assigned case qualifies as prior art under 35 U.S.C. 102(f) or (g) and the conflicting inventions were not commonly owned at the time the invention in this application was made. In order for the examiner to resolve this issue, the assignee is required under 37 CFR 1.78(c) and 35 U.S.C. 132 to either show that the conflicting inventions were commonly owned at the time the invention in this application was made or to name the prior inventor of the conflicting subject matter. Failure to comply with this requirement will result in a holding of abandonment of the application.

A showing that the inventions were commonly owned at the time the invention in this application was made will preclude a rejection under 35 U.S.C. 103(a) based upon the commonly assigned case as a reference under 35 U.S.C. 102(f) or (g), or 35 U.S.C. 102(e) for applications filed on or after November 29, 1999.

Conclusion

36. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. They include one or more limitations in the claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elizabeth Quan whose telephone number is (703) 305-1947. The examiner can normally be reached on M-F (8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill Warden can be reached on (703) 308-4037. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Elizabeth Quan
Examiner
Art Unit 1743

eq
March 18, 2003

Jill Warden
Supervisory Patent Examiner
Technology Center 1700